Z-F-87

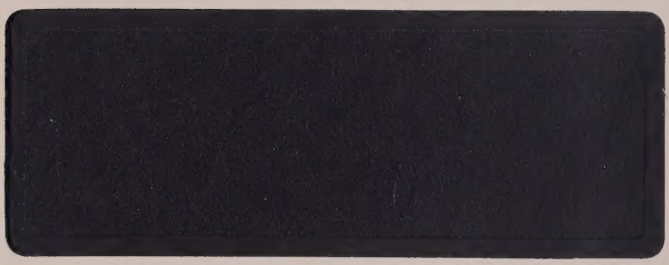
FEC

INSTRUCTIONS FOR

MODEL SR200EHM

VOLTAGE REGULATED POWER SUPPLY

ENDEVCO CORPORATION



MODEL SR200EHM

VOLTAGE REGULATED POWER SUPPLY

SPECIFICATION SHEET
FOR
MODEL SR200EHM VOLTAGE REGULATED POWER SUPPLY

ELECTRICAL

Voltage Range:	0 - 24 VDC
Line Regulation: (% of setting)	0.1% or 3 mv (whichever is greater) (95 - 135 volts)
Load Regulation: (% of setting)	0.1% or 3 mv (whichever is greater) (No load to full load)
Ripple:	1 mv RMS
Noise to Ground:	10 μv p-p measured across a 350 ohm bridge
Output Current:	0 - 200 ma
Leakage Resistance:	10,000 megohms
Temperature Stability: (% of setting)	.005%/° F
Supply Voltage:	95 - 135 VAC, 50 - 400 cps
Transient Response:	Regulation is maintained within the specified band over input line transients within the input voltage range.

ENVIRONMENTAL

Ambient Temperature Range:	+40° F to +120° F

PHYSICAL

Dimensions:	3-7/16" high x 2-27/32" wide x 12-1/8" deep
Weight:	4-1/4 pounds
Mounting:	Up to six channels may be installed in the rack adapter Models R13BC (wired) or R13B (unwired). The rack adapter requires 3-1/2" of panel space with a depth of 16-1/2".

INSTRUCTION MANUAL

FOR

MODEL SR200EHM VOLTAGE REGULATED POWER SUPPLY

1.0 GENERAL

Power supplies used as transducer excitation voltage must satisfy a broad range of requirements. The single channel power supplies manufactured by Endevco Corporation have been designed specifically with instrumentation systems in mind and represent a well-regulated, isolated type of power supply. This instruction manual describes the Model SR200EHM Power Supply.

2.0 OPERATING INSTRUCTIONS

2.1 Controls

The output voltage is continuously variable over the entire range by means of the screwdriver adjustment located on the front panel.

The momentary contact switch ("Monitor") is used to monitor the output voltage. When operated, this switch applies the output voltage to the monitor terminals of the connector. These terminals may be connected to a precision voltmeter. The ENDEVCO® Model ENO-2 Meter Monitor Panel is available for this purpose.

2.2 Remote Sensing

Since the wires going to the load have a certain amount of resistance, the point where regulation occurs should be properly established at the load itself. A provision has been made to physically move the error sensing point from the unit to any point at which regulation is to be maintained. Pins 7 and 8 on the connector have been tied together internally, as have pins 15 and 16. These two jumpers can be removed, and the connection between pins 7 and 8, and pins 15 and 16, respectively, can be recreated at the point of measurement.

CAUTION: Care must be taken to connect pin 15 to pin 16 (positive) and pin 7 to pin 8 (negative). An error in connection would damage the unit.

3.0 CIRCUIT DESCRIPTION

General

Regulation of the power supply is obtained by comparison of the output voltage with stable reference voltage through the use of a differential amplifier. Any difference voltage is amplified and resulting signal used to correct the output voltage.

3.1 Reference Voltage

The reference voltage is obtained through the use of a two-step Zener diode circuit. The first stage of reference regulation is diode CR 6. This circuit provides current to diode CR 7 that is constant within 1% as the line voltage varies from 95 to 135 volts. The second step (diode CR 7) operates at a zero temperature coefficient condition in conjunction with R17 and provides a 1% regulated reference voltage. Components CR 6, CR 7, and R 17 constitute a matched set and must be replaced as a group to insure proper operation. See Parts List for correct Endevco part number.

3.2 Error Correction

A matched pair of transistors, Q5 and Q6, comprise a differential amplifier. A portion of the output voltage is applied through a ten-turn helical potentiometer, R8, and compared with the reference voltage at the base of Q6. Any difference voltage is coupled from the collector of Q5 to a convential amplifier, Q4. This amplified error signal is in turn applied to the base of an emitter follower, Q2. The output of Q2 is used to control the voltage out of the series regulator, Q1. A portion of the unregulated supply is coupled through R4 to the base of the second half of the differential amplifier, Q5, to compensate for changes in line voltage. To this same point, a portion of the .5% regulated voltage from CR 6 is applied through R 11 to correct for any change in reference voltage that is not regulated by CR 7. Due to the differential nature of correction, temperature changes in the comparison amplifier are applied equally to the reference signal and the output voltage, thus cancelling the effects of temperature changes.

Q3 regulates the collector voltage to the differential amplifier, Q5 and Q6.

C4 provides high frequency roll-off to limit the high frequency response of the amplifier, preventing high frequency oscillations.

Q2 is a small signal transistor, and in order to limit the power dissipated in it, the collector voltage is supplied by the low voltage winding of T1.

4.0 INSTALLATION

4.1 Physical

The Model SR200EHM Power Supply may be installed in standard 19" cabinets using rack adapters Model R13B or R13BC to accept up to 6 channels per adapter. The use of Model C3 blank panels is recommended in all vacant positions to ensure proper airflow around the instruments.

4.2 Electrical

Refer to the schematic section for connections to the wired rack adapter Model R13BC.

Connections to the power supply are listed in the following table.

Connector J-1, Amphenol 26-4100-16P
MATE, Amphenol 26-4200-16S

Pin Number	Circuit
1 and 9	115 VAC
3,4,6,11,12 and 14	Chassis ground
5	Monitor negative
7	External sensing negative
8	Output negative
13	Monitor positive
15	External sensing positive
16	Output positive

5.0 MAINTENANCE

5.1 Checkout Procedure

The following checkout techniques are used at Endevco Corporation and are recommended for your use. Instruments and equipment required are:

1	Oscilloscope
1	Volt-ohm-meter (Simpson 260 or equivalent)
1	Variac capable of varying AC input from 95 to 135 VAC
1	Stable reference source, such as Model SR-200EP, SR-200EHP or mercury batteries
1	Precision DC voltmeter, capable of reading 0 to 2.5 millivolts with adequate short term stability (Model ENO-2 or equivalent)
1	Calibrated, very low noise amplifier

5.1.1

Adjust the power supply output voltage to 24 volts. The output ripple as observed on the oscilloscope should be less than 1 millivolt rms at line voltages between 95 to 135 VAC.

Connect a 5 watt resistor across the output, of proper value to draw 200 ma (120 ohms for the Model SR200EHM at 24 volts). Repeat the above check. Ripple should be less than 1 millivolt rms.

5.1.2

Connect the output of the power supply under test to a stable DC voltage source and precision voltmeter as shown in Figure 1. Vary the output to obtain a null (1 millivolt or less). Vary the line voltage from 95 to 135 VAC. The change in output voltage should be less than 0.1% of the output (24 millivolts for 24 volts output).

5.1.3 To Measure Load Regulation

Under the conditions stated above, connect a 5 watt resistor across the output of proper value to draw 200 ma. The change in output voltage should again be less than 0.1% of the output. Interconnecting wires should be as short as possible since separate error sensing lead connections, with internal jumpers between pins 7-8 and 15-16 removed, are required. Resistance of the sensing leads must be less than 70 millohms to maintain the 0.1% regulation.

CAUTION: Be sure to maintain correct polarity of the sensing leads. (Pin 15 to 16 and Pin 7 to 8).

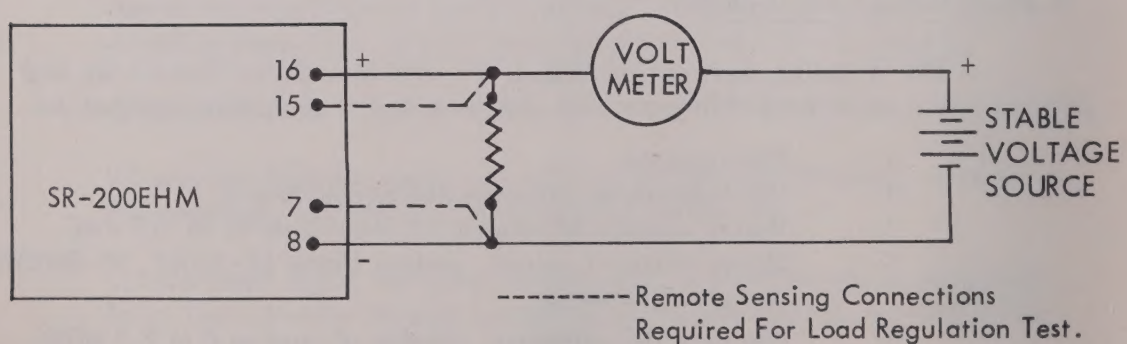


FIGURE 1

5.1.4 Due to the extremely low noise and hum generated by the Model SR200EHM, unusual care must be exercised in the selection of test equipment and interconnecting wires. This measurement must show actual power supply noise, giving due consideration to noise inherent in the test equipment. In view of the small signal to be measured, a calibrated, noise-free amplifier is required for an undistorted true measurement. If such an amplifier is not used, there may be a 60 cycle ripple present in the indicating equipment which will give an erroneous reading. A Tektronix Type 530 or 540 Oscilloscope with a Type 53/54E Preamp may be used. However, there may be 20 microvolts or more of ripple present in the Preamp. All such noise contributions of test equipment must be subtracted from the readings.

Connect the output of the power supply to a shielded and balanced 350 ohm bridge as shown in Figure 2. The output of the amplifier is in turn connected to the oscilloscope. All leads must be carefully shielded, as well as the strain gage. All chassis and shields are tied together as shown, and grounded at the input to the oscilloscope.

The noise contributed by the isolated supply will be the difference between the peak amplitudes of the oscilloscope display when the power supply is energized and when it is deenergized. With sufficient care, in eliminating external noise from the system, this noise will be found to be less than 10 microvolts peak-to peak.

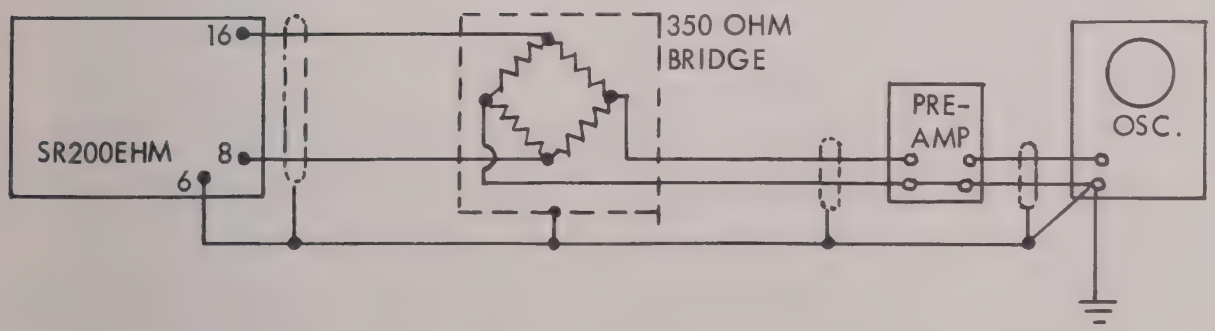


FIGURE 2

5.2 Maintenance Suggestions

Since the error amplifier is a DC coupled servo loop, failure of a component in any one stage will alter the voltages in all other stages, both succeeding and preceding the point of trouble. Voltage measurements on the transistors should be made with this in mind. The point of difficulty can best be localized by looking for a stage with contradictory operation, i.e., a transistor with the base back biased, and yet the transistor is not cut off as shown by a large voltage drop across the collector load resistor.

The regulating capabilities of the power supply are used to reduce the ripple in the output by a factor of approximately 1000. As a result of this, any malfunctioning in the power supply regulating circuitry will produce excessive ripple in the output.

5.3 Replacement of Components

Specially selected replacement components can be purchased from Endevco Corporation. Some of the components whose values must fall within certain prescribed limits, are selected for special circuit functions.

Such selected parts, as well as the parts manufactured by Endevco Corporation are identified in the Part List. Order these parts direct from Customer Service, Endevco Corporation, 801 South Arroyo Parkway, Pasadena, California.

REPLACEABLE PARTS LIST FOR MODEL SR200EHM

Cir. Des.	Description	Manufacturer and Part No.	Endevco Part No.
R1	Resistor, 680 ohm	Allen Bradley Type "EB"	ER563
R2	Resistor, 3.3 K	Allen Bradley Type "GB"	ER330
R3	Resistor, 2.2 K	Allen Bradley Type "EB"	ER311
R4	Resistor, Calib.	Allen Bradley Type "EB"	-----
R5	Resistor, 2.2 K	Allen Bradley Type "EB"	ER311
R6	Resistor, 4.7 K	Allen Bradley Type "EB"	ER183
R7	Resistor, 3.3 K	Allen Bradley Type "EB"	ER315
R8	Potentiometer, 2 K, WW	Voak Eng. Type AV	ER415
R9	Resistor, 3.9 K	Allen Bradley Type "GB"	ER564
R10	Resistor, 3.3 K	Allen Bradley Type "EB"	ER315
R11	Resistor, 3.3 K Resistor, 100 M Resistor, 6.8 K	Allen Bradley Type "EB" Allen Bradley Type "EB" Allen Bradley Type "EB"	ER315 ER305 ER282
R12	Resistor, 220 ohm	Allen Bradley Type "EB"	ER191
R13	Resistor, 2.2 K	Allen Bradley Type "EB"	ER311
R14	Resistor, 350 ohm, ±1%, 3 W	Dalohm RS-2B	ER508
R15	Resistor, 4.7 ohm	Allen Bradley Type "GB"	ER332
R16	Resistor, 400 ohm	IRC Type PW-5	ER374
R17	Resistor	Endevco	11793-2
R20	Resistor, 100 ohm	Allen Bradley Type "EB"	ER302
C1	Capacitor, 290 µf, 3 V	Sprague 89D118	EC136
C2	Capacitor, 250 µf, 50 V	Mica-Mold 929-764	EC148
C3	Capacitor, 250 µf, 50 V	Mica-Mold 929-764	EC148
C4	Capacitor, 20 µf, 50 V	Sprague 89D190	EC145
C5	Capacitor, 20 µf, 50 V	Sprague 89D190	EC145
C6	Capacitor, 250 µf, 50 V	Mica-Mold 929-764	EC148
C7	Capacitor, 290 µf, 3 V	Sprague 89D118	EC136

PARTS LIST (continued)

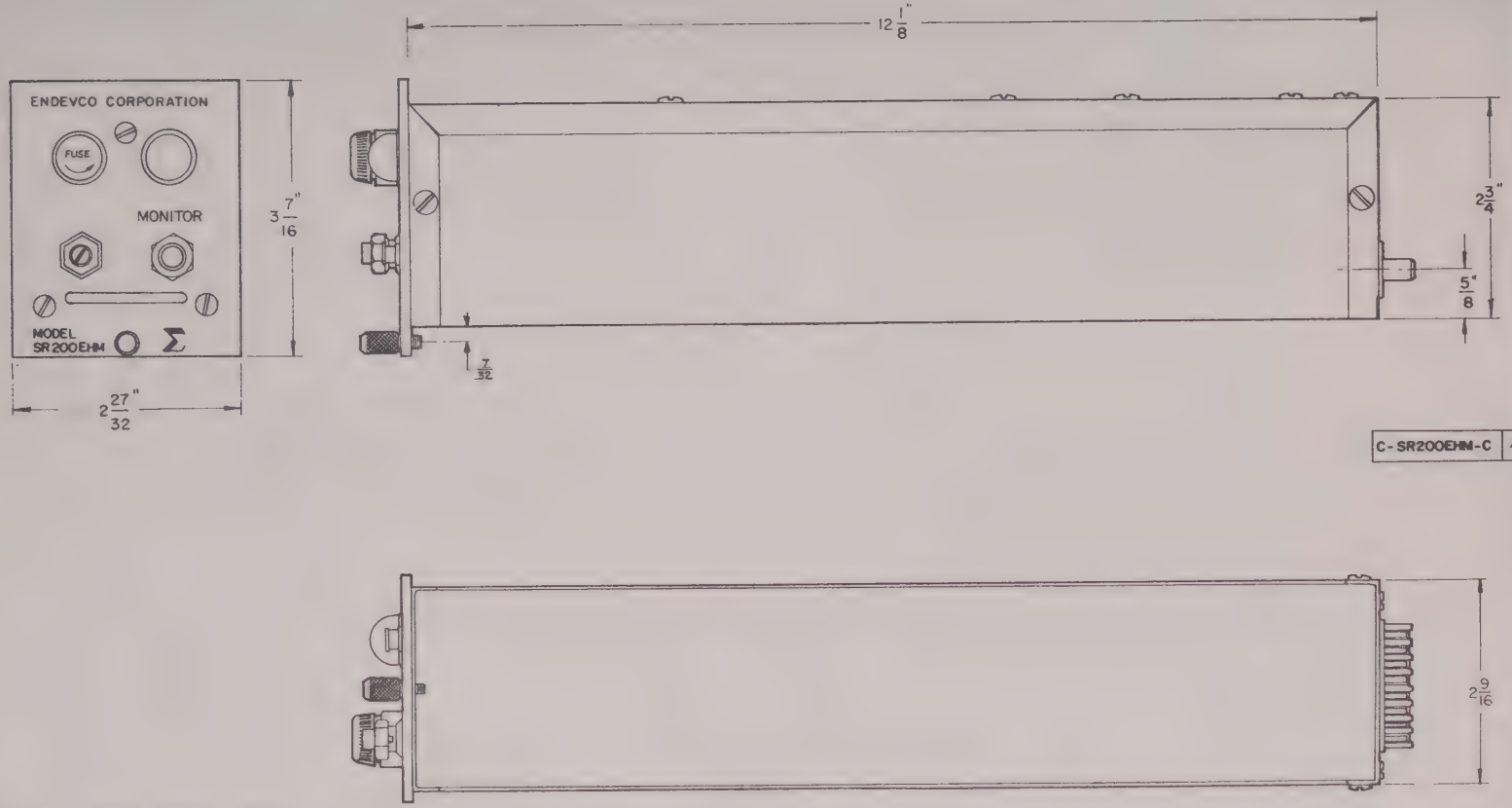
Cir. Des.	Description	Manufacturer and Part No.	Endevco Part No.
CR1	Diode	General Electric 4JA2FX355	ECR69
CR2 CR3 CR4 CR5	Diode-Quad	Mallory 1N2092	ECR48
CR6*	Diode	Endevco	11793-2
CR7*	Diode	Endevco	11793-2
Q1	Transistor VI 103	Endevco	12841
Q2	Transistor VI 110	Endevco	EQ42
Q3	Transistor VI 110	Endevco	EQ42
Q4	Transistor VI 104	Endevco	EQ46
Q5	Transistor VI 101	Endevco	EQ43
Q6	Transistor VI 101	Endevco	EQ43
DS1	Lamp	General Electric 1819	E17
XDS1	Lamp Socket Assembly	Dialco 95-810MB-972	EX16
F1	Fuse	Littelfuse 312.300	EF6
XF1	Fuse Holder	Bussman Mfg. HKP	EXF4
F2	Fuse	Littelfuse 313.300	EF19
XF2	Fuse Holder	Littelfuse 357001	EXF3
S1	Switch	Switchcraft 3S-1356	ES33
T1	Transformer	Endevco	TS1053
	Transformer	Endevco (used on SR200EHM-M15)	TS1142
	Front Panel Silk Screened (11466AW)	Endevco	11466-2
	Cover	Endevco	11468
J1	Connector	Amphenol 26-4100-16P	EJ77
	Mating Connector	Amphenol 26-4200-16S	EP115
	Mating Connector (Hooded)	Amphenol 26-4301-16S	EP116

*CR6, CR7 and R17 must be replaced as a matched set. SR200EHM matched set No. 11793-2.

BILL OF MATERIAL

PART NO.	DESCRIPTION	QUAN.
SR200EHM-1	POWER SUPPLY ASSY.	1
RI3B	RACK	OPT.
EJ79	CONNECTOR, AMPHENOL 26-4200-16S	#
EP116	CONNECTOR, AMPHENOL 26-4301-16S	#
RI3B3	RACK	OPT.
RI3BC	RACK	OPT.

CHG	E O	CHANGE DESCRIPTION	BY DATE	CHK	APPR
2	1555	RELEASED FOR MOLDED PANEL CONFIGURATION ADDED NOTE 3			
3	1808	CLARIFIED NOTE 2			
4	1946	NOTE 5 ADDED			



C-SR200EHM-C | 4

NOTE:

1. SIX MODEL SR200EHM POWER SUPPLIES WILL FIT INSTRUMENT RACK NO. RI3B, RI3B3, OR RI3BC FOR 230 V UNIT, RACK NO.'S ARE RI3B-M15 OR RI3BC-M15.
*2. EJ79 (PANEL CONNECTOR) OR EP116 (HOODED CONNECTOR) WILL BE SHIPPED AT ADDITIONAL COST, IF SPECIFIED ON ORDER.
3. THIS DWG. SUBJECT TO FUTURE CHANGE WITHOUT NOTICE.
4. UNIT WT. = 4 LBS 5 OZ.
5. IF UNIT IS WIRED FOR 230 VOLT OPERATION, MODEL SERIAL PLATE WILL CARRY MODEL SR200EHM-M15.

ENDEVCO CORPORATION Pasadena, California

SPECIFICATIONS UNLESS OTHERWISE NOTED

LIMITS OF DIMS: ANGULAR ·, FRACTIONAL ±1/32, DECIMAL ± —

1 BREAK ALL SHARP CORNERS .005 MAX.
2 SURFACE ROUGHNESS 63 MICROINCH RMS MAX.
3 DIAMETERS TO BE CONCENTRIC WITHIN .010 T I R
4 FILLET RADIUS .010 MAX

SCALE 1 — DO NOT SCALE DRAWING

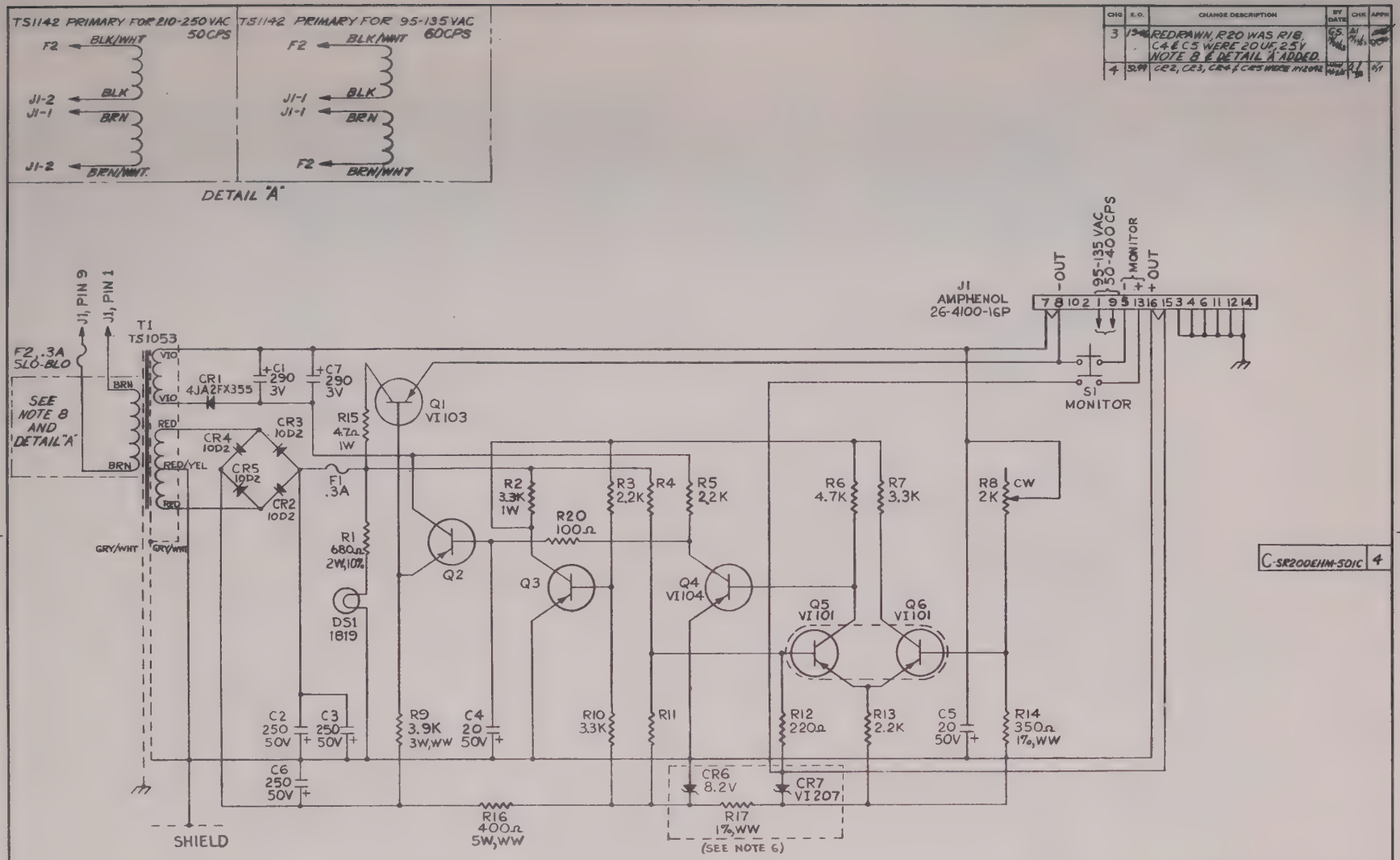
MATERIAL —
FINISH: —

DRAWN BY [illegible] 5-1-63
CHKD BY [illegible]
PROJ. ENG [illegible]

SR200EHM-M15	PART NAME	C-SR200EHM-C
SR200EHM	POWER SUPPLY	CHG 4
PRODUCT		

IMPORTANT NOTICE: INFORMATION DISCLOSED BY THIS DRAWING IS COMPANY CONFIDENTIAL. REPRODUCTION, DUPLICATION, OR MANUFACTURING RIGHTS GRANTED BY WRITTEN PERMISSION ONLY

DIETERICH POST CLEARPRINT 1000H-M



NOTES
1. ALL TRANSISTORS V1110 UNLESS OTHERWISE SPECIFIED.
2. ALL RESISTORS ½ W, 10% UNLESS OTHERWISE SPECIFIED.
3. ALL CAPACITORS IN MFD.
4. R4 AND R11 ARE CALIBRATION RESISTORS.
5. COMPONENTS AS GIVEN OR THEIR EQUIVALENTS.
6. CR6 MATCHED WITH CR7 & R17 PER 11793-2.
7. THIS DWG. SUBJECT TO FUTURE CHANGE WITHOUT NOTICE.
8. FOR 230 VOLT OPERATION, REPLACE TS1053 (T1) WITH TS1142 WIRED PER DETAIL 'A'. THIS MODEL WILL BE DESIGNATED ON NAMEPLATE AS SR200EHM-M15.

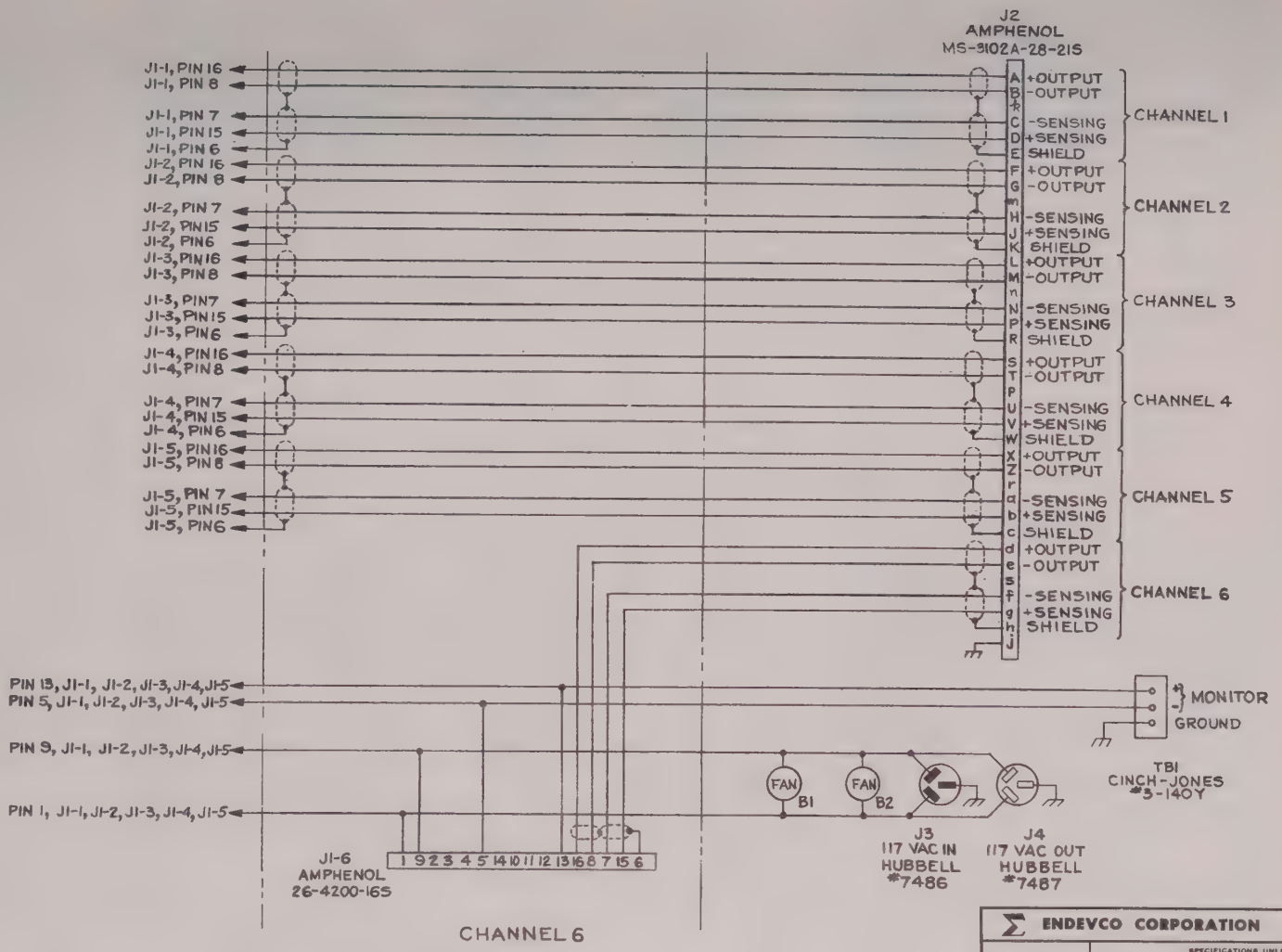
ENDEVCO CORPORATION Pasadena, California

SPECIFICATIONS UNLESS OTHERWISE NOTED
LIMITS OF DIMS.
ANGULAR ±
FRACTIONAL ±
DECIMAL ±
SCALE: DO NOT SCALE DRAWING
MATERIAL:
FINISH:
1. BREAK ALL SHARP CORNERS .008 MAX.
2. SURFACE ROUGHNESS 63 MICROINCH RMS MAX.
3. DIAMETERS TO BE CONCENTRIC WITHIN .010 T.I.R.
4. FILLET RADIUS .010 MAX.
DRAWN BY: G.S. 10-31-63
CHKD BY: 10/31/63
PROJ. ENG:

SR200EHM-M15
PART NAME:
SR200EHM
PRODUCT
SCHEMATIC DIAGRAM
C-SR200EHM-501C
CHG 4

IMPORTANT NOTICE: INFORMATION DISCLOSED BY THIS DRAWING IS COMPANY CONFIDENTIAL. REPRODUCTION, DUPLICATION, OR MANUFACTURING RIGHTS GRANTED BY WRITTEN PERMISSION ONLY.

CHG	E.O.	CHANGE DESCRIPTION	BY DATE	CHK	APPR
1	1468	RELEASED, DWG.# WAS V1844 SENSING LEADS ADDED.	ET 3/16/65	RJ 3/16/65	OEM



C-R13BC-501C CHG. 1

NOTES:
1. ONLY ONE OF SIX TYPICAL CIRCUITS SHOWN.

ENDEVCO CORPORATION Pasadena, California

SPECIFICATIONS UNLESS OTHERWISE NOTED

LIMITS OF DIMS.
ANGULAR ± —
FRACTIONAL ± —
DECIMAL ± —

1. BREAK ALL SHARP CORNERS .005 MAX.
2. SURFACE ROUGHNESS 63 MICROINCH RMS MAX.
3. DIAMETERS TO BE CONCENTRIC WITHIN .010 T.I.R.
4. FILLET RADIUS .010 MAX.

SCALE: NONE — DO NOT SCALE DRAWING

MATERIAL: —
FINISH: —

DRAWN BY: ET
CHKD BY: RJ 3-26-65
PROJ. ENG.: OEM WB

PART NAME: SCHEMATIC DIAGRAM
PRODUCT
C-R13BC-501C CHG 1

IMPORTANT NOTICE: INFORMATION DISCLOSED BY THIS DRAWING IS COMPANY CONFIDENTIAL. REPRODUCTION, DUPLICATION, OR MANUFACTURING RIGHTS GRANTED BY WRITTEN PERMISSION ONLY.

DIETZGEN CH-POST CLEARPRINT 1000H-10

ENDEVCO FIELD ENGINEERING OFFICES

If there are any questions concerning this unit, please be sure to contact the nearest Endevco Field Office or the Factory directly.

EASTERN REGION

Edward J. Quinn
440 Lexington Street
Auburndale 66, Massachusetts
Area Code: 617
Phone: WOodward 9-8063

Fred Lieb
912 Bob Wallace Avenue, S.W.
Huntsville, Alabama
Area Code: 205
Phone: 536-1051

H. N. "Hal" Gilmore
1578 Akron Peninsula Road
Akron, Ohio
Area Code: 216
Phone: 929-3811

Len Leopold
195 Nassau Street
Princeton, New Jersey
Area Code: 609
Phone: WAlnut 4-3297

Robert L. Karlson
306 Busse Highway
Park Ridge, Illinois
Area Code: 312
Phone: 825-4600

A. Wayne Williams
220 West Street
Annapolis, Maryland
Area Code: 301
Phone: 268-2566

Lewis E. Drake
202 Federal Highway #1
Lake Park, Florida
Area Code: 305
Phone: 848-3819

WESTERN OFFICES AND MAIN PLANT

Frank Benedict
801 South Arroyo Parkway
Pasadena, California
Area Code: 213
Phone: 795-0271

Ed Rempalski
801 South Arroyo Parkway
Pasadena, California
Area Code: 213
Phone: 795-0271

Carl Nicolino
801 South Arroyo Parkway
Pasadena, California
Area Code: 213
Phone: 795-0271

V. L. McKelvy, National Sales Mgr.
801 South Arroyo Parkway
Pasadena, California
Area Code: 213
Phone: 795-0271

Glenn Birdsell
801 South Arroyo Parkway
Pasadena, California
Area Code: 213
Phone: 795-0271

Warren M. Zuckert
Endevco Corporation
1890 Embarcadero Rd.
Palo Alto, Calif. 94303
Telephone: (415) 321-3994

WARRANTY

Endevco Corporation warrants each new instrument to be free from defective material and workmanship for one year from date of sale to the original purchaser. This warranty does not extend to vacuum tubes, transistors, diodes and choppers in the units, nor to units which have been misused or used in violation of Endevco recommendations, or to units which have been altered or repaired outside Endevco's factory. Defects covered by this warranty will be remedied at no charge provided the instrument is delivered to the factory with all transportation charges prepaid. If upon examination it is found that the defect is not within the scope of this warranty, a statement of repair charges and a request for authorization to proceed will be submitted.

Revised January, 1965